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# Land Conservation Education Program

## Readings

### Grades 10 - 12

Heritage Fund

Alberta
ENVIRONMENTAL PROTECTION

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## Introduction

This package of Readings is a collection of information about environmental topics in Alberta specifically related to land use, management and reclamation. They are intended as support material for topics addressed in social studies and the "STS connection" in general science (10, 20 and 30), biology and chemistry courses at the high school level.

You are welcome to duplicate any of the Readings for classroom use. The questions at the end of each Reading are meant to provoke thought and discussion. Students should become more aware of some of the environmental problems and issues faced by Albertans. Students should also gain a greater appreciation for the complexity of environmental issues, whether the issue is in or out of province. Finally, we hope the Readings will pique student's curiosity and provide them with incentive to learn more about the environment in general.

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# Reading #1 Three Eras of Agriculture in Alberta

In the late 1800's and early 1900's, homesteaders settled in Alberta where they developed the land for its agricultural potential. Today, with over 51,000 farms covering approximately 51 million acres (about one third of the total area of the province), agriculture remains important to Alberta's economy. In fact, the business of agriculture, including secondary food processing, infuses over 9.1 billion dollars into the economy. The economic value of the industry has increased since the days of the homesteaders. Farming methods employed during these early years have also changed considerably. The methods they brought from their "homelands" have, over many decades, been studied, developed and tailored to better suit the soils, climates and other conditions present in Alberta. These changes have been geared to both increase the productivity of soils and to reduce the negative impacts of agriculture on the land.

## Before World War II

George Robertson has been involved in agriculture in Alberta for most of his life. George was born in 1912 in Grassy Lake, Alberta. In 1914, his family was among the first settlers to move to the new town of Foremost. His father established a general store in Foremost and, in 1921, purchased 320 acres of land approximately five kilometres north of the town. Men were hired to work on the farm until 1930 when George took over the farm, and wheat was grown on this land until 1941.

Farming at that time in southeast Alberta was extremely difficult. George recalls that until about 1920, many farmers used horses to do the farm work. Some farmers had steam tractors, but such tractors were inefficient because they required large amounts of coal and water to operate. Water in south-east Alberta was difficult to obtain and often had to be transported long distances to the fields for the tractors. By the 1920's, kerosene and gasoline-powered tractors were available and most farmers switched quickly from horses to these tractors. A small tractor could easily do the work of ten or twelve horses. As a result, grain production increased dramatically.

At that time there were no chemical pesticides, and the use of fertilizers, except for some well-rotted manure, was rare. Work on the fields consisted of cultivating, seeding, and thrashing the grain at the end of the summer. In southern Alberta, many factors worked against the harvesting of a good crop, including drought, grasshoppers, weeds, and hail. George recalls that around Foremost between 1917 and 1929 there was only one good year for growing crops. By 1929 many of the original homesteaders had abandoned their fields and moved elsewhere. The Great Depression, which started in 1929, lasted until 1939. During that time, the price of wheat was so low that very few farmers could make a living producing it. In the mid-1930's, the federal government sponsored a program whereby settlers could load their belongings onto boxcars, and the government would pay for freight charges to transport them elsewhere in Alberta. Some of George's neighbours were so desperate for work that they took this opportunity to leave southern Alberta.

George remembers the tremendous problem of soil erosion faced by farmers in those days. As soon as the land was plowed, wind erosion began. Little was known about soil conservation practices, so many of the farming techniques used were ones that were successful in other parts of the world. Summerfallowing was very common. This is a practice of leaving a piece of land uncropped for an entire growing season, although it was commonly cultivated several times during the summer. Summerfallowing was designed to conserve moisture, to give the land a "rest" so the nutrients in the soil would not be depleted, and to control the growth of weeds. Another common practice was to burn off the crop stubble in the fall, to make seeding easier in the spring. Both practices left the soil exposed to the elements throughout the winter, which often resulted in soil erosion. Large, single fields without shelterbelts were also conducive to erosion. In southern Alberta, a large amount of topsoil was lost to wind erosion.

The land that George farmed was flat, and the topsoil was only about five to ten centimetres thick. There were many small rocks scattered across the surface. George cultivated and seeded using a tractor. Due to the nature of the work, and partially because he farmed during the Depression, George had a very small return on his investment. In 1941 he rented his land and, soon after, sold his land to a neighbour.

**The 1950's**

After World War II, George studied agriculture at the University of

Alberta. In the ten years since he sold the farm in Foremost, George found that the agriculture industry had changed tremendously. George's studies included field crops, soil conservation techniques, the use of fertilizers and pesticides, and he was introduced to farm equipment that he had only dreamed of while living in Foremost. After graduating, he went to work as an agricultural Field Man for the Municipal District of Starland, north of Drumheller. Part of his work involved introducing the farmers to new chemicals, machinery, and farming techniques. Most farmers made regular use of fertilizers, had their seed treated with pesticides at the seed cleaning plants, and sprayed herbicides onto the fields.

These new chemicals were the result of the growth of the petrochemical industry following World War II. Fungicides, insecticides and herbicides greatly reduced losses in yield to insect and fungus pests and weeds. The new tractors, especially the diesels introduced in the early 1950's were much more powerful and economical than the gas and kerosene tractors. Other types of farm machinery were also more efficient than those used in the 1930's. All of this new technology resulted in a tremendous increase in grain production in Alberta.

When George recalls the farming practices of that era, one topic he would rather forget is the types of chemicals that were used as pesticides. Chemicals that were commonly used included Dieldrin, Aldrin, 2,4,5-T, and DDT. These chemicals were in widespread use around the world because they eliminated the pests that were causing damage to crops. However, later studies would show that these chemicals were also very stable, meaning that their life span was very long. They remained a threat to the farmers, the communities, and the natural environment long after use. In recent years, the use of many of these chemicals has been banned in North America as well as in other parts of the world.

The conservation of soil became increasingly important to the agricultural industry in the 1950's, and resulted in many changes in agricultural techniques. Very few farmers burned off the stubble each year. Windbreaks were being introduced, and George knew of many farmers in other parts of the province that practiced strip cropping. Some of the greatest causes of soil erosion were summerfallowing large fields and plowing down or burning stubble. George recalls that even though the practices were discouraged, each summer a large percentage of the total land eroded because of summerfallow. Topsoil could be seen blowing off the fields when it was left exposed.

Generally, the type and quality of soil conservation practices varied from farmer to farmer. However, many farmers were very concerned about conserving the topsoil. The Alberta Department of Agriculture offered seminars regularly to introduce farmers to new techniques which would help to increase production and reduce soil erosion. Many farmers would leave these sessions with new ideas for their operation.

**The 1990's**

Bob Ohlhauser has been a farmer in the Carbon area for many years and has been concerned about the conservation of the soil on his land. He has taken great pride in carefully managing the soil, to maximize the yield from his fields and to conserve the soil on his land for the future.

Until the mid-1970's Bob practiced summerfallowing. On windy days he could hear some of the topsoil from his land blowing against his house. The sound bothered him so much that often he would stay in the basement of his house until the wind died down. In 1976 he decided that he had to try something to conserve the soil on his land. While Bob realized that summerfallowing may be seen as a necessary way of managing soil in some parts of Alberta, he noticed that much of the soil was eroding from his land. He gradually reduced the amount of land in summerfallow each year, until by the early 1980's all of his land was cropped. Every year since then, he has practiced continuous cropping (keeping fields covered in crops and stubble) and the results have been tremendous. Bob has found that the topsoil is in good condition; it is thick, moist, and rich in organic matter. His yield has been as good or better than in previous years, and he no longer hears the sound of eroding soil whipping against his windows.

In order to crop continuously, he has to manage his land carefully. Bob has to replace the nutrients that are removed from the fields each year as he harvests his crops. Therefore, he finds that he has to add slightly more fertilizer to his field than his neighbours who continue to summerfallow without keeping stubble on the land. To control weed growth, Bob uses approximately the same amount of herbicides as his neighbours, and has had no continuous problem with weeds.

Bob also tries to conserve the soil on his land in other ways. Some of his neighbours still burn off the crop stubble, while others cultivate their fields in the fall to turn the stubble into the soil, so the fields are ready for seeding in the spring. These two farming methods can leave the soil exposed to wind and water erosion all winter. Bob often leaves the crop stubble on his fields over the winter. Only if the previous year's crop was extremely thick will he cultivate in the fall. However, when he cultivates he does so in such a way that there is lots of stubble left covering the soil surface. This cover on the fields is called crop residue. An air seeder is used to seed directly into this residue in the spring. Leaving stubble on the fields may take a bit more effort when it comes time for seeding, but Bob feels that he is more than compensated, because more moisture is held in the soil and soil erosion is minimized.

Many farming techniques that lead to soil erosion are commonly practiced throughout Alberta. Bob feels there is a great deal of tradition built into the agricultural industry, and many farmers continue using these agricultural methods because that is how they have farmed for years. Also, techniques like summerfallowing are relatively easy routines that, once started, seem to persist. He is very concerned, however, because he can see soil from many fields in his area eroding each year. He says the soil on some of his neighbour's fields is thin, dry, and contains a small amount of organic material. These fields will slowly become less and less productive, and unprofitable to farm. Bob would like to see each farmer take the time to try modern soil conservation techniques and to find and practice those that work best for their land. If each farmer would do this, then soils in the province could be conserved.

## The Future

Practices in agriculture have certainly changed over the years, but the basic requirements remain the same: land that is fairly flat covered in topsoil that is rich in nutrients, capable of supporting crops and a suitable climate. Somebody must also take on the responsibility of becoming a steward of the land, improving its capabilities to support growth, and ensuring that land degradation does not occur. In a sense, the word "steward" is synonymous with the word "farmer". Considering the amount of time it takes for 1 cm of topsoil to develop (approximately 40 years) soil conservation remains crucial. Farmers are aware of the need to protect their soils from erosion and nutrient deficiency. They are also aware that society depends on them to provide food. While cities and towns are spreading onto better agricultural lands, the population throughout the world continues to rise. Farmers strive to provide these growing numbers with food that they are expected to grow on ever-shrinking farmlands. This pressure forces farmers to intensify their practices so that they attain optimum yields of crops. In addition, farmers throughout the world are forced to begin farming marginal agricultural land. Pesticide and fertilizer application becomes an important part of some practices. The general public's concerns over the use of chemicals on crops is increasing, to the point that many find the use to be non-acceptable. Many people are looking for "organically grown" foods instead of those on which pesticides have been sprayed. Farmers, however, know that in order to grow crops on such a large scale and to remain competitive, they must use some pesticides. Even pesticides do not ensure a profitable crop. There are always risks other than diseases that are involved, like changes in climate, including extremes of hot, cold, dry and/or wet weather.

Much has changed over the past one hundred years in the science and business of agriculture. Research into new and improved methods is crucial if society is to be fed and if the land is to remain in a state that is capable of supporting growth. Much of this research is done in cooperation with or initiated by the farmer, who has a vested interest in managing the land with conservation in mind. Sustainable agriculture is now beginning to replace the early methods of farming. It can be briefly defined as, over the short and long term, enhancing productivity of the soil and associated environment, leading to economic viability and a better quality of life for both the farmer and society. Not every farmer can employ practices that are exactly the same in order to be environmentally sustainable. Every region, and in many cases, every farmer requires tailored methods to meet specific needs. However, achieving sustainable agricultural development is now a goal of many farmers, regardless of their farm location.

**Questions:**

1. Compare the differences in farming practices in the eras presented in the reading. How has soil conservation been improved? Describe the methods that have resulted in increased yields.

2. Describe the factors that contributed to the erosion of large quantities of soil in south-east Alberta in the 1920's and 1930's.

3. Why were there very few soil conservation techniques in the early era of farming in Alberta?

4. Consider the pros and cons of the use of pesticides and chemical fertilizers in the agriculture industry.
   a) Do you agree with their use, or are you in favour of "organic farming"? Support your answer with reasons.
   b) If we were to ban the use of pesticides and chemical fertilizers all over the world, what sort of impacts do you foresee in the agriculture industry and industries associated with it? Explain your answer. When answering, remember to also consider changes that might occur in food production itself.

5. a) What are the issues and concerns regarding the impact of agriculture on the land?
   b) Are there some (issues and concerns) that generate a difference of opinion in terms of whether there's actually a problem or whether certain solutions can work or are appropriate? Explain.

### For Research:

1. Various innovative people and agencies in Alberta, from the early 1900's to present day, have made great discoveries and progress in the field of agriculture. For example, the Noble Blade was developed by Charles Noble in Nobleford, AB. Agriculture Canada operates a research station in Lethbridge, AB. Choose an important achievement made in Alberta pertaining to agriculture. Research and summarize it in a brief report.

One source of information is the video *Gone With the Wind ... Too?* by Alberta Agriculture, Food and Rural Development. Contact their District Office nearest you or write:

Film Library - Information Services Division
Alberta Agriculture, Food and Rural Development
7000 - 113 Street
EDMONTON, AB T6H 5T6
Fax: 427-2861 (no phone orders accepted)

## Reading #2 Urbanization

The land provides us with food, space, building materials, petroleum products, and many more resources. As populations increase, demands for these resources also increase. Less than half of the land area in Alberta is suitable for agriculture. Yet, at the turn of the century, the province was settled mainly for agricultural purposes. It is not surprising that the major towns and cities in the province are situated on the better agricultural lands. More and more rural dwellers are heading to cities to find work. As more people move to urban areas, more housing is required to accommodate them. When new houses are constructed, they are often built at the outer edges of cities, in subdivisions. As more houses are built, the more the city spreads out to permanently cover more agricultural land. It gets covered with homes, airports, parking lots, roads, shopping centres and more. Businesses and industries also begin to move to the larger urban areas. This spread of towns and cities onto rural land is called urbanization.

Other people are attracted to urban centres for work but they prefer to live in the country so they build homes in rural areas and commute to work each day. Although their homes are situated on agricultural land, they don't farm it. As a result, fewer farmers are expected to provide growing numbers of people with food on an ever-shrinking agricultural land base.

The following article, from the March 23, 1992 edition of the Edmonton Journal is reprinted with permission by the Edmonton Journal.

### Where town meets farm, a nose-to-nose battle

by: Jim Farrell, Journal Staff Writer

**Lamont**

The sign on the outskirts of Lamont doesn't tell the whole story. "City Living Country Style," it proudly proclaims. What it doesn't state about the farming community 60 km northeast of Edmonton is that country life can also stink, or that the smell of manure wafting from a farm on the town's eastern edge has riled residents of a nearby subdivision.

Some were so mad last summer they circulated a petition which convinced town council to issue a stop-work order against Hank Stach's 40-year-old family farm.

"Sure, the sign says 'City Living Country Style,' but there's too much country here for me," says Melanie Russell.

Russell decided to act last August when a heat wave drove the odor-level sky high and filled the evening air with dense clouds of flies.

Stach got the stop order lifted by meeting with the town's development-appeal board and by agreeing to do what he could to reduce the smell.

But Stach is still a worried man. The prevailing northwest wind might shift while he's spreading manure over his fields and send a bad smell over the subdivision southeast of his farm. Or residents may think a swarm of flies that bred in the neighborhood garbage cans came from his property.

Most of all, he's afraid that if his neighbors begin complaining again, he'll be shut down. That would be disastrous for a family operation that supports himself, his wife, his parents and two grown sons.

"It's hard on me, it's hard on the boys," he says.

"This has taken 10 years off my life."

Stach traces the origins of the problem back to 1977 when the farm was still outside the town limits. Town officials informed him they wanted to expand the town and in future the farm would pay taxes to the municipality, not the county.

Stach and his father Mike, who'd begun the farm in 1952, protested but couldn't stop the annexation. Soon afterward, the town began building a subdivision across the street.

Russell and her husband bought a house in that subdivision last summer.

"When we moved here it was an exceptionally warm summer," she says.

"It wasn't so much the smell that bothered us, it was the flies."

"Within a few days, we should have gone after the realtor. I never knew we had a cattle operation next door . . . I'd like to ring his neck."

Russell saves her most scathing criticism for the town administration.

"It's the town's fault," she says.

"They never should have allowed the subdivision to be built here."

The Lamont manure squabble is a sign of growing discord between townsfolk and farmers, says Alberta's farmer's advocate.

"Ten years ago we never had these complaints," says Downey, who works for Alberta Agriculture.

"In the past few years it's taken up most of my time. What's unusual in this case is Stach's position across the street from a 70-acre subdivision."

Taking the advice of government waste-management specialists and insect specialists may help a farmer reduce his nuisance factor, but it will never allow that farmer to eliminate them, Downey says.

"There's not much room for improvement . . . We have to try and have townspeople realize the realities of life, that we all have to eat."

Dennis Stadnick, a town councillor and a member of Lamont's Development Appeal Board, agrees.

"If he follows the guidelines outlined by our board, people will have to live with it," Stadnick says.

He disagrees with Russell's contention that it was a mistake to allow a subdivision to be built so close to the Stach farm, however.

"There are farms all around Lamont'" he says.

Russell realizes some of her concerns aren't shared by many people in the community whose lives depend on farming. She's concerned she'll be known as a "farm basher."

But she was pleasantly surprised last summer when she helped start a petition against the smell and swarms of flies wafting over her subdivision. Dozens of her neighbors signed up.

"I don't want to shut him down but I don't want 300 cattle across the street either," she says.

This case is not unique in Alberta; nor is it unique to Canada or elsewhere in the world. Agricultural land is disappearing quickly - approximately 10 acres per day of Class 1, 2 and 3 agricultural land. As populations rapidly rise, it is crucial that we manage the land to accommodate more people while sustaining our agricultural land base. The challenge is to find a way to accomplish this.

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## Questions:

1. a) What is urbanization?
   b) Why is urbanization an increasing problem in Alberta?

2. The newspaper article discusses two opposing views of a subdivision in Lamont built near a cattle farm.
   a) Who are the key players?
   b) What are their views on the situation?
   c) Based on the information provided, which view do you support?

3. Before we become actively involved in issues, it is important that we learn all of the correct facts.
   a) What other information would you require in order to publicly voice your opinion about this issue?
   b) If you were the reporter, who else might you interview in order to get "all the facts"? Explain your choices.

4. a) Offer some solutions to the problems of : -1- overpopulation, -2- housing shortages, and -3- urbanization.
   b) How would you convince others to agree with your solutions?

5. What else, besides urbanization, reduces the amount of land available for agricultural purposes?

## Extensions:

1. Instruct half the class to assume the role of Hank Stach and the other half to represent Melanie Russell. Have the class defend their position by writing letters as if they were addressing Lamont's Development Appeal Board.

2. Stage a debate in the classroom based on the newspaper article. Choose some of the students to represent Lamont's Town Council; divide the others so that some represent Mrs. Russell and some represent Mr. Stach.

3. Research the problem of urbanization in the rest of Canada or in other parts of the world.

## Coal Mine Reclamation

Luscar Ltd. has been involved in the mining of coal in Alberta for over 80 years. In the early years of coal mining in the province, little thought was given to what the site would be used for after the mining was completed. Most mine sites were abandoned, leaving the land in a degraded condition. Some scars are still visible today and remind us of the ever-increasing importance of land reclamation. All coal mining companies are now required to reclaim their mine sites. When reclamation is complete, the site must have the same productive capability as before mining began. Luscar takes this task of reclamation very seriously.

Coal mining has been an important industry throughout Alberta's history. Millions of tonnes of Alberta coal has been mined and shipped all over the world. Currently, approximately 85% of the electricity consumed in Alberta is generated from coal. Some of Alberta's coal is also shipped to Ontario and the Far East for power generation and steel manufacturing. The coal found in Alberta is highly sought after for many reasons, some of which are:

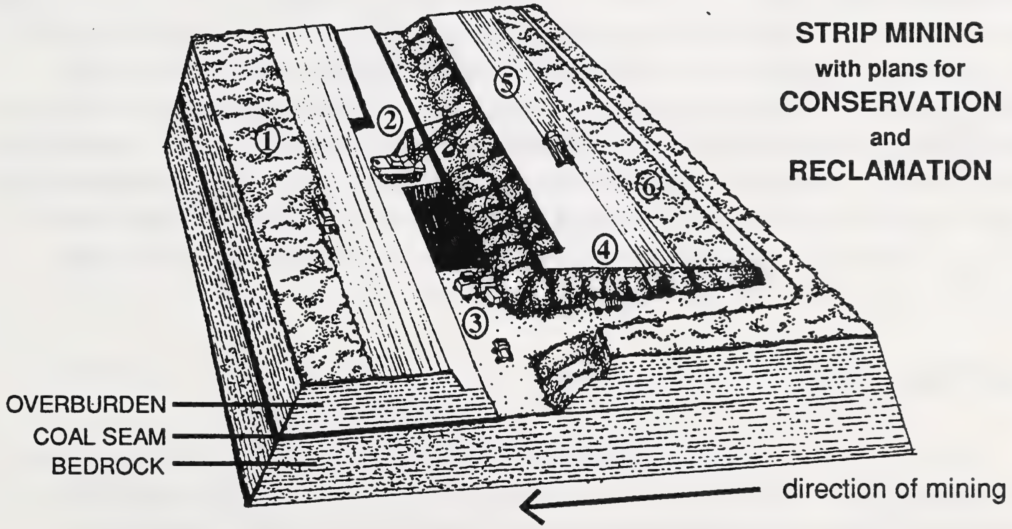
1) The sulphur content in the coal deposits in Canada decreases from east to west. As a result, Alberta's low sulphur coal burns relatively cleanly with low volumes of sulphur dioxide emissions. Coal mined from eastern Canada generally has a much higher sulphur content.

2) The coal found in Alberta is of very high quality. There are four general types of coal: anthracite (highest quality) bituminous, subbituminous and lignite (lowest quality). The quality is distinguished by the carbon content in the coal: as carbon content increases, the amount of energy produced by the coal also increases. The coal found in Alberta's mountains and foothills regions is bituminous, while the coal found on the plains is subbituminous. Bituminous coal is used in industries such as steel making, which requires a hot, clean-burning coal. It is also exported for power generation because the customer wants maximum heat value without having to pay transportation fees for ash and moisture. Subbituminous is commonly used for local electrical power generation.

3) Alberta has lots of coal - approximately 80% of the coal reserves in Canada. Much of it is quite close to the land surface, and is easily mined

using surface mining techniques like strip or open pit mining. Underground mining, used to extract coal from far beneath the surface of the land, is more difficult.

Reclamation is a process that must be included in any mining operation. The site must be examined prior to mining and plans must be in place as to how it will be developed and reclaimed and what the land will be used for after reclamation is complete. When open pit or strip mining begins, first the topsoil is carefully scraped off, removed and stored (or, depending on what stage the coal mining is in, it may be placed directly on mined land that has already been contoured). In some situations, the subsoil may be removed in the same way. Then the overburden, which is the remaining soil and rock material covering the coal, is removed. Finally, the coal is removed. The coal is usually found in seams, with a layer of rock or interburden separating each seam. Once the coal has been mined, the interburden, overburden, subsoil (if necessary) and finally the topsoil is replaced. The site is then seeded with vegetation that is consistent with the proposed land use. On many reclaimed sites, it is impossible to tell that the site was ever disturbed.



**STRIP MINING**
with plans for
**CONSERVATION**
and
**RECLAMATION**

**STRIP MINING**

1. Topsoil and suitable overburden is stripped before mining for later replacement.
2. A dragline removes the overburden down to the coal seam.
3. Large, off-road trucks haul coal to the processing plant.
4. "Spoil" piles left by the dragline are recontoured into suitable topography.
5. Soil that was stripped and stored before mining is replaced to produce equivalent soil capability.
6. An area roughly equal to that disturbed each year is revegetated.

While reclamation may appear to be a relatively straight forward process, it can be complicated a great deal by the local conditions of the mine. On three of their mine sites in Alberta, Luscar Ltd. is faced with very different and difficult challenges. At all three sites they have overcome these obstacles, and have seen their reclamation projects become successful.

### Paintearth Mine

The Paintearth Mine is located close to Forestburg, Alberta. Annually, it supplies 2 million tonnes of subbituminous coal to the Battle River Generating Station of Alberta Power Limited. Before mining development, the land was used for agriculture. Therefore, the mined land will be reclaimed to a condition where sustainable agriculture can again be practiced.

While reclaiming land to agricultural uses can be a simple procedure, reclamation is complicated at the Paintearth Mine because the subsoil can be saline or the soil can be Solonetzic. This means that the subsoil can contain high concentrations of salts. As a result, it can form a series of dense vertical columns called hardpan. This hard layer slows down water movement and makes it difficult for plant roots to penetrate. The soil is then somewhat unproductive. To prevent contamination of good quality subsoil with saline or Solonetzic soil, the good quality subsoil is removed and salvaged down to the salt or Solonetzic layer. Once the mining is complete, this good quality subsoil is replaced on top of the overburden and covered with topsoil. Careful salvage and replacement of good quality soil materials often result in the site having a higher productive capability than before mining. Within three years after strip mining is completed, the site can again be used to produce crops.

### Coal Valley Mine

The Coal Valley mine is located in a remote location in the foothills, approximately 88 kilometers south of Edson. The annual production capacity of this mine is approximately 2.0 million tonnes. The coal is shipped to Ontario and abroad to be used in electrical generating stations. Two types of mining are practiced at this mine. Where coal has formed in a pod formation, open pit mining is used to remove the coal. The topsoil, subsoil and overburden is salvaged from a fairly large area, then the entire coal pod is removed before the soil is returned. Where the coal has formed in a more consistent seam, strip mining is used, as at the Paintearth Mine.

The area surrounding the Coal Valley mine is typical of the Foothills Natural Region. The terrain is gently rolling hills which are generally covered in lodgepole pine forests. The area is being managed for multiple uses, including forestry, the petroleum industry and outdoor recreation. In this area it is easy to find the remains of a series of coal mines that were active from the early 1900's to about 1950, and Luscar does not want to leave the same types of scars behind. When reclamation is completed, Luscar wants a gently rolling forested terrain which can support the same range of activities that existed before mining, i.e. wildlife, forestry, recreation, etc.

The complications surrounding the reclamation plans on this mine are similar to those facing the forestry industry in general in this area. First, the soils are fairly thin and easily eroded. Therefore, the careful removal of this material before mining begins is essential. Second, managing the growth of the new forest is complex. For them, reforestation is dealt with in a slightly different fashion than forestry companies after harvesting.

1) In other managed forests, deciduous plant species like aspen poplar and willow often invade the harvested sites and compete with the planted conifers. The area surrounding the mine site is primarily a dense lodgepole pine forest with few deciduous plants. A mature stand of lodgepole pine exists around the site. The understory contains species which are shade tolerant and do not like the open sun-exposed reclaimed site. Therefore, very few native deciduous seeds reach the reclaimed area.

2) Often the lodgepole pine seedlings are browsed by various animals. Luscar has tried to reduce the resulting loss through the use of companion planting. Various hardwood species are planted along with the lodgepole pine seedlings. The browsing animals have a preference for the hardwoods, and the lodgepole pine seedlings are spared. This technique has proven to be very successful.

These management techniques have allowed the forests on the reclaimed sites of the Coal Valley mine to become established with great success. Luscar is proud of the fact this success has, to date, been accomplished without the use of chemical herbicides. The forests that are growing on these reclaimed sites are now being used by many native animal species, and will be available for harvesting in the future.

Two post-mine lakes have also been constructed in the final cuts of dragline pits. These pits were contoured and aquatic vegetation and benthic (found at the bottom of a waterbody) organisms were transplanted from nearby natural waterbodies. Detailed monitoring has revealed that the lakes exhibit qualities needed to establish a viable sport fishery. The lakes have also attracted a variety of waterfowl to the area including geese, ducks and loons.

### Cardinal River Mine

The Cardinal River Mine is located south of Hinton along the eastern slopes of the Rocky Mountains. This mine produces approximately 2.5 million tonnes of coal each year, to be shipped to major markets in Japan and Korea, mainly for use in the production of steel. The mine actually consists of many open pit mines working at the same time. As the coal in each pit is depleted, the site is reclaimed.

The reclamation of this area is probably Luscar's greatest challenge. The subalpine setting influences the cool and windy climate, with high levels of precipitation. This harsh climate makes the development of soil a slow and difficult process, so if there is a soil layer it is very thin and fragile. Many of the mine pits are located on steep slopes, which greatly increases the risk of erosion. Also, the site is in the headwaters of several streams, making the management of the siltation of soil and bedrock materials very important. The goal of the reclamation of this area is to return the site to a state where biodiversity of the native wildlife species, including bighorn sheep, can be sustained.

After the soil and the overburden is removed and stockpiled, mining begins. When the mine is depleted of coal, the pits are backfilled, the overburden dumps are contoured, and covered in what little soil there was to begin with. The sites are then fertilized and seeded with a mix of plants that grow very quickly and are palatable for the local wildlife. The fast growing plants are needed to hold any soil material that remains in place. In some areas, the reclaimed soil is replaced in islands, and larger plants like willows and alders are planted on these islands. These islands are placed in locations that provide protection for the wildlife. The slopes are left fairly steep, to provide escape terrain for bighorn sheep.

Although the completed reclamation has been successful, research continues in order to improve the techniques and practices used. One indication of this success is that the population of bighorn sheep on the reclaimed area has increased from approximately 40 before mining to approximately 280 today. The mine has become an important procurement area to obtain sheep for later transport to areas where populations have declined or dwindled.

Reclamation of disturbed land sites is not always an easy job. However, with planning and careful implementation during the development of the site, the reclamation of a site to a condition of equal or greater productivity is possible. Like other mining companies, Luscar makes great attempts to manage the land so that it will be conserved for the future.

In Alberta, the Conservation and Reclamation Council (CRC) ensures that land is reclaimed to standards. The CRC requires companies to outline their plans for reclamation in their initial development plans. Companies are liable for the site they disturb. The reclaimed site is then examined by a Conservation and Reclamation Inspector. If successfully reclaimed, the company is issued a reclamation certificate. Security bonds, totalling millions of dollars, are posted by the company to guarantee the reclamation.

**Questions:**

1. a) What is reclamation?
   b) Why is reclamation important?

2. a) Why do you think that reclamation did not become a standard part of industries that disturb land such as coal mining until fairly recently?
   b) How has the attitude of society changed regarding natural resources since the early 1900's?

3. a) Which of the three mines described above presented the most difficult challenges to reclamation? Why?
   b) Describe the methods used by Luscar to overcome the challenges in each mine.

4. a) Describe how successful reclamation can benefit Luscar and other companies that disturb land.
   b) If you were a mine manager, would reclamation be a priority for you? Explain your answer.

5. a) List some of the points for and against the expansion of coal mining in Alberta. Do you think the industry should be expanded?
   b) If you think expansion should be allowed, under what conditions would you allow it?

## Additional Sources of Information:

**The Coal Kit** - a package of 15 factsheets, a video and teaching ideas available to educators from:

The Coal Association of Canada
Suite 502, 205 Ninth Avenue S.E.
CALGARY, AB T2G 0R3
Tel: 262 - 1544
Fax: 265 - 7604

## Reading #4 The Story of Keephills

Approximately sixty percent of the electrical power that is used in the province of Alberta is produced by three power generating plants operated by TransAlta Utilities near Lake Wabamun. These plants are located about seventy kilometres west of Edmonton. The Sundance and Keephills plants are situated on the south side of the lake, while the Wabamun generating station is on the north side of Lake Wabamun. These power plants are fueled by coal taken from two large surface mines: the Whitewood mine on the north side of the lake, and the Highvale mine on the south side. Together, these two mines form the largest coal mine in Canada in terms of coal produced.

In 1976 only the Wabamun and Sundance plants were operating, and TransAlta Utilities could barely produce enough power to keep up with forecasted consumer demand. TransAlta proposed to expand the coal reserve at the Highvale mine and develop the new Keephills power generating plant. However, situated on the new coal reserve was the hamlet and surrounding community of Keephills.

The community of Keephills consisted of about 110 families spread over approximately 218 square kilometres. The area was first settled in the early 1900's, when a sawmill was the major employer. Later, much of the land was cultivated and agriculture became the most important industry. In the 1970's the population increased due to rural residential developments. Much of the population consisted of young families with small children. Many of the residents had lived their entire lives in Keephills and looked forward to having their children settle in the area as well. The hamlet of Keephills was old and established, home to four families and the site of the community hall and school. This hamlet was the social and cultural centre of the community.

About 62 square kilometres of the area was destined to be disturbed by the mine. Approximately 10 square kilometres of the Keephills area would be affected by the power plant, cooling ponds, ash lagoon and railway spur leading to the new Keephills plant. Included in this area was the hamlet of Keephills. It was estimated that the site of the hamlet covered two million tonnes of coal. If the mine and power generating station were to proceed, these people would have to be moved.

When TransAlta Utilities approached the community with plans for the new power generating station and mine, the immediate response of the people was that they did not want to lose their homes and their identity as a community. The community was well aware of the importance of the resource that was beneath their homes, and was not generally in opposition to the expansion of the mine. However, they did not want a complete disruption of their lives either, and wanted fair treatment by TransAlta Utilities. With support from TransAlta, the citizens formed the Committee on Keephills Environment (COKE) in January of 1977 to represent the citizens of Keephills in negotiations with TransAlta. This was the first local advisory group in Alberta created in response to resource development in the province.

The formation of COKE was the start of six years of hard work by TransAlta Utilities and many members of the Keephills community. COKE, TransAlta, and the County of Parkland entered into negotiations about the future of the hamlet. It was decided that the best solution was for TransAlta to move the hamlet to another site within the region, but away from the proposed mine. It was also decided that instead of moving the buildings from the old site, TransAlta would develop a new subdivision, build new houses for the four families from the old hamlet and build a new school and community centre. Other sites would be made available to other residents of the community who would be displaced by the mine but wanted to remain in the community. There would also be sites for future developments like a store, gas station, or church. Any remaining sites in the subdivision would be made available to the general public. It was agreed by the residents that the total population of the proposed subdivision should not exceed 110 people. The new subdivision was designed to maintain the rural feeling of the original hamlet, while still providing social and cultural services.

The next issue was the site of the new hamlet. Members of COKE toured the area and made three recommendations to TransAlta about prospective sites. By June of 1979, TransAlta had purchased options to buy on two of the sites. A site eight kilometres northeast of the original hamlet was finally chosen. The site was covered in a beautiful jack pine forest with a nearby creek. Located approximately two kilometres from a highway, it allowed easy access, yet was far enough removed from the highway that noise would be reduced. Road construction at the new site began in the spring of 1981, and a large ceremony celebrating the sod turning for the new school and community centre occurred October 21, 1981. On October 8, 1982, the community held a grand opening celebration at the new complex. Also in 1982, the four families were moved onto the new site. The new hamlet of Keephills was complete.

Since then, the subdivision has flourished. Several new families have moved in, and the student population in the school has increased. While old-time residents of the community can no longer come back to see the sites and buildings they were familiar with, the new community is thriving. Once again it serves as the social and cultural centre of the area.

The six years between the first introduction of the mine plans by TransAlta and the completion of the new site was a time of hard work, negotiations and communications between COKE and TransAlta. The citizens of Keephills are impressed with the new subdivision, and while they would have preferred not to have been moved, they are now pleased. The citizens were also impressed with the willingness of TransAlta to cooperate with COKE, to make the required move as comfortable as possible.

The work of COKE is not finished. Since the new Keephills has become established, COKE has also taken on a partnering role to TransAlta Utilities on many other issues, including: the transfer of land ownership from Keephills residents to TransAlta, monitoring the environmental quality of the community and the mine site, reclamation of the mine, land productivity studies and water well inventories.

TransAlta also works with other committees which have been established to monitor their work. One of their ongoing problems is that of blowing coal dust from the mine site. TransAlta has been addressing this problem through experimentation and research so that the coal dust does not affect the surrounding area. To keep dust down, they spray water the coal haul roads. They have found that water works as well as any other material they've used. They also seed the top of the storage piles of coal. In the past, they covered them first with topsoil and then seeded them. Now they find that seed will grow directly on the coal. To date, they have not been able to eliminate this problem of blowing coal dust, but they continue to address it.

TransAlta also addresses problems with groundwater which may be affected by mining activities. If they receive a complaint, they will invite a hydrogeologist to the site to perform tests, the results of which indicate the nature of the problem. Once the problem is determined, they will take appropriate action.

The role that COKE has played in the development of the Keephills generating station and the expansion of the Highvale mine has forever changed how industries that develop land deal with the general public. COKE has shown that a local advisory group can effectively represent local citizens in negotiations with a major corporation like TransAlta Utilities.

## Questions:

1. Does a company such as TransAlta Utilities have the right to displace people like they did in this case? Give reasons for your answer.

2. a) Why was the local advisory group so important in the development of the new site? What role did they play?
   b) What do you think would have happened to Keephills if COKE had not formed?

3. a) Did TransAlta have to go to the lengths that it did to satisfy the needs of these people? Why or why not?
   b) Should the company have gone further? Explain your answer.

4. What would you do if a major company approached you with a proposal similar to that of TransAlta Utilities?

## Further Reading for Discussion:

Residents of Cadomin now (1993) face a situation that is similar to the story of Keephills. Luscar Ltd., the parent company of Cardinal River Coals, has proposed to mine an area that is about a half mile away from many homes in Cadomin. Residents first voiced concerns with the original proposal in 1989. In 1991, the Cadomin Environmental Protection Association (CEPA) decided to work with Cardinal River Coals to find a compromise - a more agreeable design. Working on the proposal has actually brought the community and the company closer together.

It had been suggested that with the abundance of coal in the Eastern Slopes of the Rocky Mountains, mining so close to Cadomin wouldn't be necessary. However, not all of the coal that is found in the Eastern Slopes is in a development zone (see Reading #8, Integrated Resource Planning). In addition, the area they want to mine is one of only a few areas where quality coking coal is found.

Part of the proposed plan involves first mining the areas closest to Cadomin, and moving away from the hamlet as they mining progresses. They also plan to develop the area rapidly so that the land is disturbed for as short a time as possible. If current plans are implemented, they will be mining between 1994 and 1998. Although the area will be reclaimed afterward, dust and noise from the mine will still present problems that will be addressed throughout development.

1. How is this situation similar to the story of Keephills?

2. In what ways does this seem different from the story of Keephills?

3. Suppose that both the Keephills and Cadomin situations presented themselves at this very moment. Suppose also that the two mines are owned by the same company. You have been appointed as the Director of Community Affairs, in which case it is your job to act as a liaison between your company and the communities, trying to keep both sides content.
   a) Given the choice, which project would you prefer to work on: Cadomin or Keephills? Give reasons for your answer.
   b) Someone else has been hired to work on the case you didn't choose. This new person has asked to meet with you to "compare notes, to see how your situation is progressing." Do you think that this is important? Why or why not?

## Reading #5 The Petroleum Industry in Alberta

Since the first major oil discovery in Alberta near Leduc in 1947, the petroleum industry has become very important to the economy of this province. With the development of the industry, however, came several concerns about its effect on the natural environment. Today, reclamation and the management and cleanup of oil and saltwater spills have greatly reduced the effect of this industry on the landscape.

Everyone who has travelled around Alberta has probably seen signs of the petroleum industry. Drilling rigs, wellheads, pump jacks, storage tanks and pipeline corridors can be found throughout the province. There are over 200,000 kilometres of oil and gas pipelines under the land surface, enough to cross the province between Montana and the Northwest Territories more than 160 times. There have been 150,000 oil and gas wells drilled in this province, of which over 70,000 have been abandoned. The total area of land that has been disturbed by this industry in Alberta is about 4,000 square kilometres, which would form a strip about 13 kilometres wide between the cities of Edmonton and Calgary.

In the early development days of this industry, little or no consideration was given to the reclamation of disturbed land. Vegetation on drilling sites and pipeline right-of-ways would be cleared and the site drilled or the pipeline constructed. When production ceased at the wellsite or the pipeline was no longer required, the site was often simply abandoned. Alberta is dotted with these degraded sites. However, since 1963 when the provincial government passed the Surface Reclamation Act, the Conservation and Reclamation Council (CRC) has been working with the petroleum industry to introduce and improve the practice of conservation and reclamation. Now, a company cannot abandon a well site or pipeline without a reclamation certificate from the CRC. For major pipeline developments, the CRC is involved from the beginning, working with the company to ensure that reclamation is properly planned and implemented. It is now quite common to have a company lease a piece of land and develop a well site one year, and have the site reclaimed and ready to be put to another use the next. While the CRC still has a large task in ensuring that each company reclaims their disturbed sites, many companies are taking the responsibility of reclamation very seriously. Theyare adequately reclaiming their disturbed sites to meet required standards.

What is reclamation? Reclamation is the handling of the soil layers so that they can be replaced on the site once the disturbance is completed. Generally, this consists of carefully stripping the topsoil from the area that is to be disturbed and storing it elsewhere for future replacement. Recently, a new system called 3-lift reclamation has been introduced where, if necessary, three different soil layers will be separately removed from the site. Once the soils have been removed, the parent material or bedrock beneath can be disturbed. After the development is complete, the soil layers are replaced in their proper sequence and vegetation is replanted on the site.

Another environmental concern associated with the petroleum industry occurs when pipelines break and oil and/or salt water is spilled. There are approximately 900 oil and salt water spills in Alberta each year. Salt water is often found in the same formations as oil and moves up the well with the oil. This mixture of oil and salt water is piped to a central facility where they are separated. From there the oil is piped to a refinery for further processing. The salt water is usually piped to a non-producing well and pumped back into the ground.

Oil can spill anywhere along the length of the pipeline, from the wellhead to the refinery. Often the cause of the spill is fatigue or corrosion in the pipe where somewhere along the line, the pipe ruptures and the oil spills. Crude oil in high concentrations is harmful to the environment. Contained with the oil are various other hydrocarbons, some of which may be toxic to vegetation or wildlife. In addition, oil and water do not mix well. As a result, land that is saturated with oil will not be able to absorb air or water. Over a period of time this may sterilize the soil. Another quality of crude oil is that many of the chemicals it contains float on water. Therefore, if an oil spill reaches a lake or river, the chemicals can spread quickly.

Over time, the petroleum industry, along with the Energy Resources Conservation Board (ERCB), has dramatically increased their success in dealing with oil spills. An organization called Oil Spill Co-operatives has been established to respond to these spills around the province. The basic principle in handling oil spills is to first remove as much oil as possible and then disperse the rest. If oil spills on a hill, trenches are dug at the bottom and may be lined with plastic so the oil will flow down and can be collected. When oil spills on water, booms are placed around the spill and the floating chemicals are skimmed off. When as much oil as possible has been absorbed, the rest is dispersed. Oil in low concentrations can be broken down by soil micro-organisms. The area is treated with fertilizers (usually nitrogen) and then left, except for monitoring. Within a few years the oil concentration in the soil drops and vegetation usually grows to cover the area again.

Late in the fall of 1979, an oil spill occurred on a forested hill sloping down to the House River just north of Boyle. The pipeline carrying synthetic crude oil from the tarsands near Fort McMurray became corroded. Before the oil was stopped, approximately 60,000 barrels of oil spilled onto the ground, flowed downhill to stain the banks of the river and finally flowed into the House River itself. Immediately after the spill, the site looked like a disaster area. The soil was soaked with oil, vegetation was dying and oil was moving downstream in the river. If this oil was not collected before it reached the ice already formed on the river, it would continue to flow beneath the ice and be very difficult to contain. The first step in the clean-up was to place a boom across the river downstream from the spill site to catch any of the oil floating on the water. As the boom of absorbent materials became saturated with oil, they were replaced. These materials were taken to a treating facility where the oil was extracted. Next, a large trench was dug at the bottom of the hill and lined with plastic so any oil flowing down the hill could be collected and later pumped out. Any soaked materials and damaged trees or vegetation were burned close to the site. When the oil stopped flowing into the trench, the remaining oil-soaked soil was set on fire to burn off the remaining oil. This burning resulted in the top inch of topsoil being sterilized, but after about one year the soil organisms had recolonized the site. The trench was left in place at the bottom of the hill for approximately two years, and periodically pumped out. After this time, the site was reseeded and by the third year, shrubs were appearing on the site; the vegetation was recovering.

Today, it is difficult to tell that there had been a spill there. Although the reclamation of that site was successful, burning is no longer a common practice for cleaning up oil spills. In most cases, the lighter oil burns off while the heavier oil remains covering the ground as an impenetrable tar-like substance. This makes reclamation even more difficult.

Salt water spills have a greater potential to harm the environment than oil spills. This water contains very high concentrations of sodium salts, as well as other chemicals. These salts are extremely corrosive, and spills often occur because the pipelines carrying the salt water are slowly dissolved. Because the salts are water soluble, they can move quickly through the soil, particularly in wet areas such as muskeg. Plants readily absorb this salty water and, because it is toxic to them, most die soon after. The clean-up crews deal with the salt water in two steps: first they flush the area with water to dilute the salt, and then treat the area with gypsum or other calcium salts. The calcium ion naturally replaces the sodium, and drives the sodium down to the bedrock. The calcium salts are not nearly as toxic to plants and other organisms as the sodium salts. In situations where large volumes of salt water have spilled, weeping tile is installed to collect the salt water and remove it. Generally, salt water spills are more costly to clean up and the site takes longer to recover. However, within a few years the concentration of salt can be decreased to where the native vegetation can once again become established and no signs of the spill will remain.

The concern for the protection of Alberta's natural environment has caused the petroleum industry to change considerably since 1963. Reclamation now ensures that the industry leaves their disturbed sites in a condition where they can soon be put to other uses such as agriculture, natural areas and wildlife habitat, to name a few. The improved expertise and technology involved in the cleanup of oil and salt water spills has reduced the long term effect of these incidents as well. Coupled with the use of pipes made of material that corrodes much more slowly, the environmental hazard associated with oil and salt water spills is not as great as it once was. The petroleum industry has responded to the demand that they minimize their impact on Alberta's natural environment.

**Questions:**

1. a) Describe why reclamation is important to the petroleum industry.
   b) Why is the conservation of topsoil on these disturbed sites so important?

2. Describe why spilled crude oil is harmful to the environment.

3. Why are salt water spills considered to be more hazardous to the environment than oil spills?

4. When a large pipeline is no longer needed, it is usually left in the ground instead of being removed and the site reclaimed.
    a) Why do you think they are left in the ground?
    b) Do you think they should be reclaimed? Explain your answer.

## Reading #6 Developing the Oilsands

Located beneath the land surface of Northern Alberta, in the region around the city of Fort McMurray, is a layer of oilsand. Oilsand is a material comprised of sand and clay mixed with a tar-like form of oil known as bitumen. The Alberta Oilsands deposits contain about 625 billion barrels of oil reserves, the largest known reserve of oil in the world. Approximately 300 billion barrels of this reserve are recoverable using current mining techniques.

The recovery of oil from oilsand is a very difficult and expensive process. There are also some environmental concerns that result from the mining and recovery process. However, as conventional sources of oil become depleted, the vast reserve of oil contained in the oilsands will become increasingly more important.

In 1963 the first major project to extract these oilsands and convert the bitumen to synthetic crude oil began close to Fort McMurray. This development was known as the Great Canadian Oil Sands (GCOS) until 1979, when GCOS and the Sun Oil Company combined to form Suncor. Production of synthetic crude oil began at the GCOS plant in 1967, and is scheduled to continue until 2003. In 1991, Suncor's oilsands facility produced an average of 60,273 barrels of synthetic crude oil per day for a total of approximately 22 million barrels per year. To date, Suncor has developed approximately 2400 hectares (ha) of land associated with their oilsands lease.

Another oilsands mining company, Syncrude Canada Ltd., was established in the 1970's to recover oil from the oilsands. The Syncrude operation has developed into one of the largest mines in the world. One major concern with the mining of the oilsands is the long term effect that the mining will have on the land. The oilsand lies from 10 to 50 metres below the land surface. To expose the oilsand layer, the overlying layers of soil and bedrock must be removed. Additionally, muskeg soils high in organic matter cover much of the lease. Before the overburden is removed, the soil is selectively stripped off and saved for use in the reclamation of the mined-over areas. The bulk of this Reading, however, will concentrate on Suncor.

Suncor has been involved in the reclamation of land on its mine site since 1971. This reclamation program has developed from the initial research project into an operational program that is successfully returning the mined-over areas of the lease into a productive forest ecosystem. These ecosystems, which are being utilized by wildlife, are developing in the same manner as undisturbed forest sites adjacent to the mining operation. Suncor's current reclamation areas visually demonstrate that techniques are available to address the environmental concerns related to the creation of disturbed landscapes. They have received national recognition for the effectiveness of their reclamation program.

Part of the management plan for reclaiming the land is a process by which the muskeg soil, salvaged from the overburden advance, is placed on the reclamation site as a soil amendment. This layer of muskeg acts the same as an undisturbed forest soil and is rich in nutrients, micro-organisms (bugs), seeds, and root fragments. This soil addition improves the capability of the reclamation site to grow plants. The reclamation site is then fertilized, seeded with barley and planted with tree seedlings. This method is successful in producing a landscape which is more productive than it was before the development of the mine.

Suncor operates an active open pit mine, so reclamation of the land is started when mining is no longer active. All areas where mining has been completed have been reclaimed up to the edges of the pit. The overburden piles, containment dykes around the tailings ponds and disturbances on the south end of the mine have all been reclaimed. Since 1971, Suncor has reclaimed approximately 435 ha of land on the mined site. Suncor's long-term management plan is to reclaim all of the mined land to a capability equal to or better than that which existed in the original soils.

One of the most difficult technical challenges for Suncor is the efficient extraction of the bitumen from the sand and clay in which it is found. The mined material contains only 8 to 18% bitumen, so it is important to recover as much as possible. In fact, the process averages an extraction rate of more than 90%. The bitumen is extracted using steam, hot water and caustic chemicals. The recovered bitumen is a very thick, black tar which is sticky and viscous. This bitumen undergoes a process called thermal cracking, which reduces the bitumen to coke and a series of distillates, or lighter petroleum products called Kerosene, Gas Oil, and Naphtha. The coke produced is used as a fuel for steam and power generation in the Suncor Utilities plant.

The petroleum products are blended together for the various customers and transported to Edmonton through a pipeline. In Edmonton the blended products are distributed to refineries where they are converted to final products. Because impurities within the petroleum products are removed at the Suncor operation, the oil products produced at the oilsands plant are preferred by refineries located in more populated areas because they generate fewer emissions.

The material left behind once the bitumen is extracted is called tailings. Tailings is a slurry (mixture of water and solids) containing sand, silt, clay, and unextracted bitumen. At the end of the bitumen extraction, the tailings are discharged into tailings ponds. The sand rapidly settles out of the tailings and is used to build dykes around the tailings ponds. Some of the clay particles remain suspended in the water and form what is called *fine tailings*. Although some of the clay particles will eventually settle, fine tailings are fairly stable and release water slowly. This stable form of fine tailings is a gel-like material that contains from 25% to 45% solids. Considerable research is being conducted by both Suncor and Syncrude on treating the fine tailings. The solids make it impossible for fish and other aquatic life to survive, yet the material is much too fluid to support other uses. As well, the water in the fine tailings contains some bitumen and other organic materials. Currently, Suncor has four tailings ponds that contain 77 million cubic metres of fine tailings and 24 million cubic metres of water. Syncrude, because of its larger size, has generated a much larger volume of fine tailings.

The long-term management of tailings is one of the greatest challenges for both Suncor and Syncrude. In cooperation with Alberta Environmental Protection, the Canadian Government, and the Alberta Land Conservation and Reclamation Council the oilsand companies are spending large amounts of time and money on research to define the best solution for the problem. Various solutions exist, but each has to be evaluated for long term environmental risk. Examples of possible solutions include:

a) Physical Dewatering - a process to physically reduce the volume of water in the tailings. The resulting material could then be handled like a solid. Processes such as freezing and thawing the fine tailings have reduced the volume of water to about 50%. Additional freezing and thawing reduces the water component further but at a slower rate. This process has been tested on small and medium field-scale trials, but still needs to be tested on a scale as large as a tailings pond.

b) Vegetative Dewatering - the Alberta Environmental Centre in Vegreville, Suncor and Syncrude have experimented with various species of plants to see if they will draw out and transpire some of the water trapped in fine tailings. Plants have been shown to effectively reduce the water content of freeze/thaw trial plots, helping to further dry the fine tailings.

c) Fine Tails Mixing - the fine tailings could be mixed into the tailings sand or overburden, and deposited in the mine waste pits. This process is difficult to implement but would provide a way of disposing of some fine tailings.

d) Water Capping - involves the development of one wet pond for fine tails reclamation. This is the process that Suncor recommended in the 1989 Development and Reclamation Application for the long term management of the fine tailings. Water capping involves the pumping of fine tailings from all four of the existing ponds to a single tailings pond located in the mine bottom in an area approximately 2 km from the Athabasca River. This pond would cover 411 ha and contain approximately 135 million cubic metres of fine tailings. The fine tailings pumped to this pond will be capped with 7 to 20 metres of water in order to start the treatment process. This water layer allows for naturally occurring organisms to digest the toxic elements released from the fine tailings. The plant growth within the pond and along the shoreline will further break down any contaminants thereby allowing the pond to develop into a productive lake. It is predicted that natural aquatic plant and animal species will successfully colonize the wet pond and create a stable, productive ecosystem over the fine tailings which are in the bottom of the lake.

The four existing tailings ponds will be filled with tailings sand and reclaimed back to a natural forest or wetland ecosystem.

> Issues still to be resolved regarding the proposed water capping system include: the depth of the top water that is required to effectively cap the fine tailings, the long-term effect caused by the gradual release of contaminants into the ecosystem, and the long-term management of the area, including the issue of public access.

An alternate to the mining methods used by Suncor and Syncrude has been explored in a project managed by the Alberta Oil Sands Technology and Research Authority (AOSTRA). AOSTRA is using new technology to tap the vast oil sands reserves and involves horizontal wells drilled from underground tunnels. The project has been through a field pilot stage and may be in full production by 1996.

The oilsand forms a 21 metre layer far enough underground that it can't be mined from the surface using technologies like those of Suncor and Syncrude. The AOSTRA technology has an advantage over surface mining in that it does not require tailings ponds. No surface mining and no tailings ponds means that surface disturbance is minimized. A drawback for the new technology, however, is that only about 60% of the bitumen is recovered from the oilsands while Suncor and Syncrude have recovered approximately 90%. Other environmental problems relating to the use of this technology have yet to be assessed.

The energy that is contained in the Oilsands of Northern Alberta will become more valuable in the future. To date, the developments of Suncor and Syncrude have tapped only a small portion of this resource using surface mining technology and, at great expense, have developed methods to extract the oil from the sand. Like all other resource developments, this development affects the land. Both companies are working to minimize the short and long term environmental impacts of their mining operation through active reclamation programs and research into techniques to effectively handle outstanding issues associated with the recovery of the oil from the oilsands.

Meanwhile, AOSTRA along with other interested oil companies continue to develop technologies to recover oil from those oilsands which can't be reached through surface mining techniques.

## Questions:

1. Compare the process of the extraction of the Oilsands and conventional crude oil (refer to Reading # 4, The Petroleum Industry in Alberta).

    a) Why is oilsands extraction so much more complicated and expensive?
    b) In spite of these challenges, Suncor and Syncrude have been mining the oilsands for many years. Why?

2. What part does the reclamation of mined areas play in the Suncor mine? Why is it important?

3. Why are tailings such a difficult technical challenge for Suncor and Syncrude?

4. a) Evaluate the three methods that have been proposed for the management of fine tailings. What are some of the benefits and drawbacks of each method? Consider each of the following parts of the environment in your evaluation: air, water, land, vegetation, wildlife, people.
    b) How do you suggest that Suncor manage these tailings?
    c) Can you think of better ways for the oilsands companies to deal with tailings?

5. a) At the current rate of production, conventional crude oil reserves in Alberta will run out in approximately ten years. One source of energy that could be developed further to replace this oil is the oilsands. Should the oilsands be developed further? Why?
    b) If you were the premier of Alberta, would you push for further development of the oilsands? If so, under what criteria would you allow development of the oilsands? If not, what other energy developments would you support?

6. At its present recovery rate of 60%, do you think it is worth the effort by AOSTRA to continue with its underground technology to mine the oilsands? Give reasons for your answer.

## Reading #7 Oil Recycling

The problem of what to do with used oil is one with which many Albertans are struggling. According to the 1993 statistics of the Canadian Petroleum Products Institute (CPPI), approximately 127 million litres of oil lubricant are sold in Alberta each year. Fifty percent or more is consumed during use by burning or leaking. Of the remaining 50% that is recyclable, less than one half (approximately 20% of the total) is now recycled. Much of the oil ends up being burned for energy, poured on roads as a dust control, improperly disposed of down sewers, in landfills, or simply dumped on the ground. Used oil is contaminated with materials such as heavy metals, phenols and other organic and inorganic substances. When used oil is improperly disposed of, these contaminants can harm the environment. Obviously, the proper disposal of oil is an issue with which Albertans must deal.

Did you know that oil can be recycled over and over? Unless it is burned, oil does not break down during use, and therefore only requires cleaning and re-refining in order to be as good as new. There are currently two major oil recycling companies in Alberta, Canadian Turbo Incorporated (Lubrefinery) in Edmonton, and Hub Oil Company Limited in Calgary. These companies use a fairly simple, three-step process to recycle used oil:

1) First the oil is dehydrated, which results in the removal of any unwanted additives like water, fuel, antifreeze, or solvents. These materials are removed, processed further, and disposed of down a deep well.

2) Sulfuric acid is then added to the oil to remove more unwanted chemicals. After 24 to 48 hours, the acid forms a sludge in the oil. This sludge is removed from the oil, turned into a solid by being combined with calcium carbonate, and disposed of in a landfill.

3) In the final stage, clay is added and the oil is heated to 260° Celsius. This clay acts as a filter and attracts any trace metals that are still in the oil. The clay is then removed and taken to a landfill site. The oil that remains is virtually the same as newly-refined oil. Twenty thousand litres of oil can go through this final stage before the spent clay must be removed and new clay added.

Is oil recycling working in Alberta? To date, it has been only partially successful. Mr. Marion Wargacki of Turbo Lubrefinery says that it is difficult to make the oil recycling business a thriving one without support of industry as well as all levels of government. The re-refining process for used oil is not overly complicated. Rather, it is the collection of used oil and the disposal of the resulting wastes that create most of the problems for the business. Following is an article from the Falher Smoky River Express newspaper of September 26, 1990, that describes some of the problems that Albertans are facing in dealing with their used oil.

## Waste oil storage sites needed in Smoky River region

by Shari Maertens-Pool

When Remi Ouellette, operator of the Texaco Bulk at Donnelly Corner, started telling farmers they could no longer discard their used oil in Texaco storage tanks, he never asked them where they would dump it.

Says Ouellette, "I didn't want to know."

But Denis Brochu, personnel manager and special projects, of Falher Alfalfa, has a pretty good idea.

"Sure, they dump it on the ground. They oil their driveways or dump it on the gravel roads to keep the dust down."

"The problem is," says Brochu, "there's no place for the farmers to take their waste oil."

Up until earlier this year, farmers were allowed to use the two 300 gallon underground tanks at the Texaco bulk station for their waste oil.

Says Ouellette, "I had to stop them because of the cost to pump out the tanks."

The closest waste oil storage tanks are in Rycroft, High Prairie, and Fairview but all three are temporarily closed. Only Berwyn's storage tank is open. Two other communities have open storage tanks in the northwest and they are High Level and Whitecourt.

"Falher Alfalfa dumps its waste oil in barrels," says Brochu. About once each month, a vacuum truck cleans out the barrels and disposes of the oil. It costs Falher Alfalfa between $100 to $200 each month for the service.

Falher Alfalfa handles only its own oil. Says manager Rene Roy, "We've got enough ourselves!"

Says Brochu, "There's just no place to put [waste oil]. It's a real problem in this area."

Adds Ouellette, "Waste oil is a serious problem getting back to the environment."

It is this serious problem that has prompted the council of the town of Falher to take some action.

"There is the possibility of getting grants from the Department of Environment for storage tanks for collection," says Gerard Nicolet, town administrator.

However, the problem lies not in establishing depots for the waste oil, but in collecting it and recycling it.

Lee Funke, public communications officer for the Department of Environment, explains that the government is attempting to advocate a user pay system. In other words, the user of the storage tank would donate money to help cover the cost of transportation.

But, Funke admits, "it's a problem" getting people to help cover the transportation costs.

Funke explains that when the program was first established by the government in 1981, the recycled oil was sold at 18 cents per litre by gas stations. However, in 1988, the market became depressed and companies started charging to pick up the oil.

There are only four oil collecting companies in Alberta. Two of the companies, in Edmonton and in Calgary, recycle the oil themselves. The other two companies, located in Red Deer and Sherwood Park, use the oil for other purposes.

Grant monies available for purchasing equipment to separate and store the waste oil goes mainly to municipalities, says Funke, who in turn pay the cost of having the oil transported for recycling.

The few non-profit organizations that have set up depots have the municipality pick up the cost of transportation.

Funke could not comment on whether or not grant money would be made available for transportation of the waste oil to recycling sites.

Falher has written the environment department asking them to establish a joint program between government and oil companies for the collection, disposal and recycling of oil.

"We're asking the government to speed up the process because there's an immediate problem," says Nicolet. "It's a serious environmental concern." Falher will be soliciting support from the other communities within the Municipal District of Smoky River.

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Industries and railways form the biggest market for re-refined oil. The general public is not so willing to use lubricating oil that has a re-refined base. Mr. Wargacki says that re-refined oil products carry with them a stigma as a result of recycling processes in the 1950's. At that time, used oil was said to be re-refined when in fact, it was simply filtered. This straining process physically removed foreign materials from the oil but it did not remove or separate any of the impurities in the oil, causing many problems for users. People remember this process and are now leery to purchase re-refined oil products.

In the early 1980's, Alberta Environment (now Environmental Protection) began the Oil Drop program. A number of years ago there was such a high demand for used lube oil that service stations and other oil collectors were paid up to 18 cents per litre for used oil. The program was successful until the price of virgin oil dropped. When the price dropped, the price of re-refined oil was high compared to crude oil and therefore not worth it for recyclers to collect the used oil. At $30.00 per barrel of crude oil, Turbo Lubrefinery can be competitive. As the price drops to $18.00 per barrel, it becomes more difficult to economically justify this service because used oil collection, waste disposal of the unwanted by-products and sludge, and the re-refining process costs remain the same, regardless of the cost for crude oil. The overhead costs of Turbo Lubrefinery has nothing to do with the price of crude oil. It produces its oil from that which has already been used. Large oil companies have their oil supplies delivered to their refineries through a pipeline, whereas recyclers must collect their own. Recently, a company called Recycled West opened in Airdrie. It also deals with used oil. Instead of recycling oil into more lubricating oil, it re-refines it into diesel fuel.

Remote areas and communities need Oil Drop locations. It doesn't pay for recyclers to drive to every service station in the province to collect used oil. People must be encouraged to use the oil drops, being careful to discard only their used oil, and nothing else into the tanks. In Europe, a tax is now levied on all oil sales. This tax goes to the oil recyclers to help offset their collection, refining and disposal costs. West Germany successfully re-refines and reuses 90 percent of its used oil. Again, government legislation is needed for this to occur.

The effects that both crude and re-refined oil have on the land should be considered. Oil is a non-renewable resource, but one which we have come to rely upon very much. Conservation of this resource is important if we are to continue using petroleum products.

**Questions:**

1. a) In Alberta, approximately how many litres per year of used oil are disposed of improperly in sewers, landfills and on the ground?
   b) Approximately how many litres of used oil are recycled?

2. a) What are the problems with oil recycling in Donnelly and area?

b) What are some solutions?
c) If you were the Minister of Environmental Protection in Alberta, what would you do to solve the problems?

3. If all oil that could be were recycled, would there be enough to supply the consumer demand without newly refined oil? Explain your answer.

4. Why can Turbo Lubrefinery be competitive with crude oil companies when the price of crude oil is $30.00 per barrel, but not when the price is $18.00 per barrel?

5. a) In Europe, a tax is levied on all oil sales and the collected money is given to the oil recycling companies. Why is this done?
   b) Do you think that Alberta should adopt this practice? Give reasons for your answer.
   c) What other methods could be used to make the recycle oil industry more lucrative to other potential recycling companies?

6. If you were the marketing and promotions manager of Turbo Lubrefinery in Edmonton or Hub Oil Company in Calgary, how would you convince the general public that re-refined based lubricating oil is as good a product as that made from virgin oil? Describe in detail your advertising and promotion campaign and techniques. If you are going to use the media in your campaign, write the advertisements you will use. To make this exercise easier, consider what you as a consumer would have to know and hear in order to convince you that re-refined oil is a good product.

## Reading #8 Integrated Resource Planning

Approximately 60 percent of the land in Alberta is owned and managed by the provincial government. Most provincial public land lies within the *Green Area*, which is forested land not available for settlement or agricultural development, other than grazing (the White Area is settled, private land). Resources found within the Green Area include timber, fish, wildlife, rangeland, petroleum, natural gas, coal, ecological and historic resources. By the 1970's, development of these resources had already seriously affected the landscape, and conflicts between different users had begun.

- Hikers Anonymous* wants the area for hiking and low-impact camping.
- Coala Coal Co.* wants to mine for coal in the same area.
- The ATV Association* wants the area restricted to ATV use.
- The local Historic Society* wants the area to be left undeveloped until they can uncover artifacts known to be in the area.

* fictitious scenario

Who will be granted use of the land? The Alberta Government recognized that better resource management with more communication and coordination among all resource users was needed. The approach was to allow for orderly development, conservation and protection of natural resources. This management philosophy, called Integrated Resource Management (IRM), recognizes that management and use of a resource may affect the way in which another resource is managed and used. The overall intent of IRM is to optimize the use of provincial natural resources to achieve maximum net benefits for Albertans, now and in the future. The IRM philosophy is applied when developing Integrated Resource Plans (IRPs) for provincial public land.

Integrated resource planning involves gathering information on proposed activities, considering the views of interested government departments, municipal authorities, interest groups and the public, and making decisions about managing public land. This planning is a means to ensure that all concerns and interests are identified and considered.

A planning team is established. It consists of people from government resource management areas (i.e. recreation, fish and wildlife) that have an interest in the planning area. A team coordinator leads the team in developing the plan.

The process of developing an IRP is difficult and may take several years to complete. For this, a series of planning steps are taken, as outlined below.

1) The planning team prepares a terms of reference report which outlines the concerns and information to be addressed. Public input is sought and considered in preparing the terms of reference.

2) Comments received from industry, interest groups and the public are considered by the planning team when developing the draft IRP. A draft plan provides objectives that show the benefits that will occur in a planning area. Guidelines describe how these objectives will be implemented. The draft plan provides recommendations on how resources and activities will be managed and developed.

3) This draft plan is then reviewed by the public and, based on their comments, the planning team makes changes to the draft and produces a final draft plan.

4) The final draft plan is reviewed and endorsed by a number of interdepartmental provincial government committees. Any outstanding conflicts are resolved before approval of the plan by the Economic Planning Cabinet Committee of the Alberta Government.

5) Once the Cabinet committee approves the IRP, it becomes the government's policy on how to manage public lands and natural resources within the planning area.

How much power does an IRP policy have? An IRP is not legislation, so its content is not law. It is intended to be a guide for resource managers, industry and the public who have responsibilities or interests in the area. The IRP can be revised or reviewed at the discretion of the Minister responsible for Public Lands.

Sometimes, potential resource developments or other land use proposals are in conflict with the intent of an IRP. Government staff will work with developers to explore other ways to accommodate the proposal. When an IRP needs to be changed, opportunities for public review will be provided. Changes to the plan may be denied, however, depending on whether or not they can be accommodated in the IRP. Any changes would then have to be approved by the government.

The first comprehensive integrated land use plan, *A Policy for Resource Management of the Eastern Slopes*, was produced in 1977 and covered the Eastern Slopes of Alberta's Rocky Mountains. It was received internationally as a progressive and effective way to manage public land and natural resources. Since then, the integrated resource planning program has expanded to all provincial public land, which includes the forests in the Green Area of northern Alberta and the public lands in the settled areas of central and southern Alberta. Detailed IRPs called subregional and local plans have been completed for most of the Eastern Slopes and parts of the rest of the province.

## Coal Branch Subregional Integrated Resource Plan

The Coal Branch Subregional IRP covers an area about 8,400 $km^2$ in the Eastern Slopes of the Rockies. The area extends from just northwest of Hinton (along Highway 16) to east of Edson, and south to the Brazeau River (see diagram on page 10). The Coal Branch area contains many natural resources including lodgepole pine and white spruce forests, coal, oil and natural gas. Fish and wildlife species also inhabit the area. Wildlife species include elk, moose, deer, bighorn sheep, mountain goat, cougar, black and grizzly bears. Most of the area is held under a Forest Management Agreement with Weldwood of Canada Ltd., to provide wood for the bleach kraft pulp mill and sawmill in Hinton.

Three coal mines also operate in the area. Luscar Ltd. has two mines: the Coal Valley mine south of Robb, and the Cardinal River mine south of Hinton. Gregg River Resources operates a mine directly across the road from the Cardinal River mine. The Coal Branch area supports large reserves of natural gas and some petroleum. There are 11 gas processing plants in the area and one limestone quarry operates near Cadomin.

Because the area is so attractive, it is heavily used for hunting, fishing, canoeing, camping, hiking, outfitting, snowmobiling and off-highway vehicle touring. Without some form of management, the area could quickly become overdeveloped, and conflicts could arise among the many users.

The Eastern Slopes IRPs provide the framework for a land use zoning classification. The public land within each IRP area is categorized into zones. Each zone is then managed according to the intent of its classification. The eight zoning classifications are as follows. Descriptions can be found at the end of this reading.

1. Prime Protection Zone
2. Critical Wildlife Zone
3. Special Use Zone
4. General Recreation Zone
5. Multiple Use Zone
6. Agriculture Zone
7. Industrial Zone
8. Facility Zone

These eight zones or categories apply throughout the Eastern Slopes region. However, other zones or land use categories may be more suitable for public land in other parts of the province.

The Coal Branch Subregional IRP is intended to be a guide for the management of future resource developments such as Weldwood's timber harvesting operations. The IRP recognizes the need to manage the land for multiple uses, rather than strictly forestry. During the development of the IRP, many conflicts among users in the area were identified, and efforts were made to resolve as many of the conflicts as possible.

One conflict has involved motorized and non-motorized recreation users along Whitehorse Creek. This beautiful valley extends just north of Cadomin, and west through the Front Range of the Rockies towards Miette Hotsprings in Jasper National Park. For many years, the campground near Cadomin was a popular starting point for backpacking and cross-country ski trips. However, by the late 1970's the area was also being used by off-highway vehicles (OHVs). Over the years, the indiscriminate use of these vehicles resulted in some erosion in the valley. That, combined with their motor noise, caused resentment among the non-motorized recreation users. This valley also provides important habitat for many wildlife species such as elk and bighorn sheep. In the IRP, it was decided that the best classification for the Whitehorse Creek area would be a Critical Wildlife Zone. As a result, OHVs are no longer permitted in the Whitehorse Creek Critical Wildlife Zone.

To accommodate the motorized recreation users, another part of the Mountain Park area (south of Cadomin) has been designated as a General Recreation Zone. Surrounding this General Recreation Zone is a large area of land that has been designated as a Critical Wildlife Zone. To prevent the General Recreation Zone from becoming an isolated, inaccessible "island," the IRP outlines the need for an access management plan in the Critical Wildlife Zone area. This plan will point out where different recreation trails will be developed for motorized vehicles and for horses. Travel off the trails will be restricted. The access management plan will also resolve the conflict between motorized and non-motorized recreation users and will ensure that wildlife can still use the area. The critical wildlife habitat at Whitehorse Creek has been protected, and the motorized recreation users have been accommodated in the Mountain Park General Recreation area.

One example of how the IRP has affected the development of natural resources in the Coal Branch area is found in the land surrounding Folding Mountain. This mountain, which was once part of Jasper National Park, is clearly visible from Highway 16 just before entering the park. Many people first strongly suggested that the land surrounding this mountain be designated as a Prime Protection Zone. However, a coal company has secured interests in a coal deposit that lies under the land surface there. If the area was zoned as Prime Protection, it would be unlikely that the coal would be mined.

As a compromise, which was eventually supported by the public, the Folding Mountain area has been designated as a Prime Protection Zone with a provision that coal exploration could proceed on the site. Any exploration must be done in such a way that fragile and environmentally sensitive terrain and valuable ecological and aesthetic resources are not destroyed. This may mean limited use of machines for coal exploration, which would identify the extent of the coal reserves. Even if there are adequate reserves for a coal mine, a public review would be required to determine if the area will be mined. A major consideration of any development on this site would be the aesthetic cost of a coal mine located so close to a major highway and a national park.

The Folding Mountain area is now protected from any major resource development and the coal company has the opportunity to find out how much coal there is. With this information, the coal company can determine the economic viability of the coal deposit for development. Should the company decide to apply to the government for development, the public will have the opportunity to indicate if they support the proposal. The public would be made aware of the impacts the development would have on the mountain landscape, wildlife and the economic growth of the neighbouring communities.

Integrated resource planning has become an important resource management technique in Alberta. The pressure we place on public land to provide Albertans with natural resources and areas for recreation and tourism has increased and will continue to increase. The IRP process lets us manage these uses for the following purposes: natural resources can be developed, the opportunities for recreation and tourism can be maintained, and the natural ecosystems are left in a condition that is sustainable for future Albertans.

**Questions:**

1. a) Describe Integrated Resource Planning.
   b) Where in Alberta is the IRP process used?
   c) Why is IRP so important?

2. a) Why does the IRP process include public reviews at every step?
   b) Do you feel that including the public is important? Why or why not?

3. When developing an IRP, it is crucial that the team coordinator be unbiased. Explain why.

4. Approximately 82% of the land in the Coal Branch IRP has been designated as Multiple Use Zones.
   a) Why do you suppose the percentage is so high in that area?
   b) Does this mean that the logging company who holds the Forest Management Agreement for that area can log 82% of the area? Explain your answer.

5. Imagine that you are the Minister of Environmental Protection. Suppose the company that holds rights to the coal near Folding Mountain has shown, through exploration, that there is a tremendous coal deposit there. The company has approached you to change the IRP so that it can begin development of the mine. In the public hearings, many people from Hinton support the mine because of the number of jobs it will create for local people, thereby serving to boost the local economy. Visitors who travel on Highway 16 to Jasper, however, are very concerned about seeing the mine so close to the mountains and the highway. Others from Alberta are concerned with the effect that the mine might have on wildlife in the area, as well as the noise pollution that will be created as a result.

   a) What decision would you make: to allow the company to proceed with mining or not?
   b) If you allow development to proceed, what conditions would you place on the development?
   c) What compromises might satisfy all stakeholders?

When answering this question, remember that the situation has been over-simplified. Before the Minister could make any such decision, the area would have to be studied, the public would have opportunity to review the plans and make comments and an Environmental Impact Assessments (EIAs) would be carried out if deemed necessary.

# ZONING CLASSIFICATIONS

## Eastern Slopes Integrated Resource Plans

1. **Prime Protection Zone**
   - areas that are considered to have environmentally sensitive terrain or valuable ecological or aesthetic resources. Generally, it represents the alpine and sensitive subalpine areas of the mountain ranges. Activities allowed in this zone include watershed protection, fisheries and wildlife management, outdoor recreation such as hunting, non-motorized trail use and wilderness camping. Approximately six percent of the land area in this IRP has been designated as a Prime Protection Zone.

2. **Critical Wildlife Zone:**
   - areas that are identified as critical habitats for terrestrial and aquatic wildlife species are identified. Key winter ranges, migration routes and calving areas for large mammals are considered. It also includes spawning areas vital to maintaining naturally reproducing fish populations. Uses acceptable in this zone include outdoor recreation activities such as hunting, fishing, trail use and wilderness camping. Industries such as trapping, logging, grazing, petroleum, natural gas, mineral and coal development are permitted under special conditions. Ten percent of the planning area has been designated as a Critical Wildlife Zone.

3. **Special Use Zone:**
   - historic areas, land set aside for scientific research, land with unique management needs, or lands under different legislative status are identified These include the preservation of the Lovettville townsite from future developments. Lovettville was the first Coal Valley community and still remains intact. The Marshybank Ecological Reserve is also recognized as a Special Use Zone. This area contains a forest landscape that includes meadows and wetlands. The ecological reserve is representative of the Main Foothills Subregion of the Foothills Natural Region of Alberta. Less than one percent of the planning area is included in this zone.

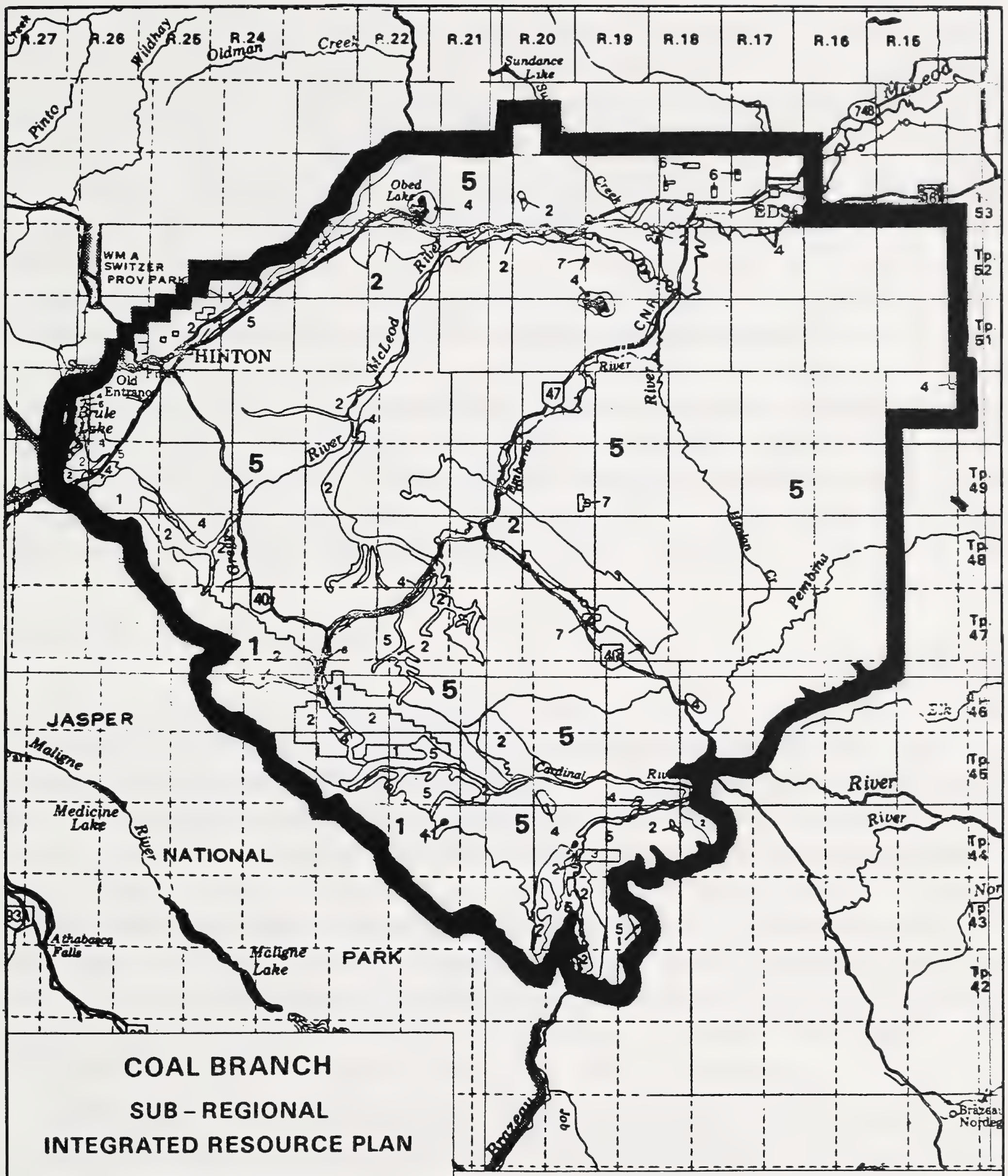
4. **General Recreation Zone:**
   - set aside are natural environments for outdoor recreation activities. Most land in this zone is found along river valleys or around lakes. Fishing, horseback riding, hiking, intensive recreation developments (e.g., golf courses) and camping will be encouraged in this zone. Hunting, off-highway vehicle use, trapping, logging, grazing, petroleum exploration and development, coal mining and transportation utility corridors may be allowed to some extent. Approximately one percent of the planning area has been designated as a General Recreation Zone.

5. **Multiple Use Zone:**
   - represented by the forested lands of the planning area, a range of resource use activities occurs here. Examples include: motorized and non-motorized recreation, hunting, fishing, trapping, camping, intensive recreation development, logging, grazing, petroleum, natural gas and coal development, mineral extraction, commercial and industrial development, transportation and utility corridors. In terms of logging, relatively small areas of the zone will be disturbed at any one time. The facilities for many outdoor recreation and tourism opportunities will be provided in this area, such as sites for off-highway vehicle use and serviced campgrounds. Approximately 82 percent of the Coal Branch area has been designated as a Multiple Use Zone.

6. **Agriculture Zone:**
   - areas that are suitable for cultivation or livestock grazing. Other uses compatible with improved grazing are permitted in this area and include the following: intensive recreation, serviced camping, commercial and industrial development. Less than one percent of the planning area can be used for agriculture.

7. **Industrial Zone:**
   - recognizes any existing or approved industrial operations such as coal mines, gas processing plants and pulp mills. Usually the sites designated under this zone are limited in size to only the land required for the development. The zone is essentially single use because the intensity of development generally precludes other activities. Less than one percent of the Coal Branch area is needed to accommodate industrial developments

8. **Facility Zone:**
   - recognizes existing or potential settlement or commercial development areas. Settlement areas usually represent hamlets, villages or towns. Less than one percent of the total planning area has been identified as a facility zone.



## COAL BRANCH

### SUB – REGIONAL INTEGRATED RESOURCE PLAN

SCALE 1 : 730 000

West of the Fifth Meridian

Planning Area Boundary ▬

### REFINED EASTERN SLOPES ZONING

1 Prime Protection
2 Critical Wildlife
3 Special Use
4 General Recreation
5 Multiple Use
6 Agriculture
7 Industrial.
8 Facility

## Reading #9 Conserving Natural Areas

Alberta is rich in natural resources. In this one province we harvest forests, cultivate land, drill for oil and gas, extract sand and gravel, and more. Flat land is suitable for agriculture, airports and constructing safe and efficient transportation routes. Our cities can spread out when required and overpopulation is not a problem right now. The province also provides Albertans, Canadians and the entire world with wonderful recreation opportunities. The mountains are a skier's dream-come-true. They are also a hiker's delight and a photographer's haven. The Foothills and the Boreal Forest Natural Regions are abundant with streams and lakes well suited for fishing, sites that are excellent for casual or avid campers, hikers, off-highway vehicle (OHV) use, hunters, birdwatchers and many other activities. The Aspen Parkland and Prairie Natural Regions offer much the same, only the scenery is somewhat different. Every part of the province has something special to offer. However, with so many people using the land, protection of the native vegetation and wildlife species can and often does, suffer.

### Protecting Natural Areas

Some land in Alberta is set aside from development, except for a few forms of low-impact recreation. Presently, the federal and provincial governments are in the process of trying to resolve how much land should be protected and how the areas should be managed.

In the early 1980's the United Nations created a special commission, called the Brundtland Commission, to study the earth's natural environment and its relationship with economics. Their findings were published in a report called Our Common Future. One of the recommendations of the report is that approximately 12% of each major natural region on the earth's land surface should be designated as Protected Natural Areas (PNAs). Many countries, including Canada, have made the commitment to reach this goal by the year 2000.

To date, only 10.2% of Alberta has been legislated as PNAs, so public pressure to conserve more land in this way is increasing. However, the issue in this province is not just the total area, but the distribution of these areas. By far the largest areas that are now protected fall within the boundaries of the National Parks in the Rocky Mountain and the Boreal

(Northern) Forest Natural Regions. The percentage of the other three major natural regions in Alberta, (the Foothills, Aspen Parkland and Grasslands Natural Regions) that is protected is very small. No land is protected in the Canadian Shield, the smallest of Alberta's Natural Regions. Most of the land in the Grasslands and Aspen Parkland Natural Regions has already been altered or developed in some way. Converting portions of these areas back to their natural state would be extremely difficult and expensive.

Albertans have some challenges ahead in trying to meet the United Nations goal of protecting 12% of the total land area from development. As each year passes, the pressure we place on the land to become more productive increases, making it more difficult to protect any remaining natural areas. When we speak of "protection from development", we tend to forget that many forms of recreation involve some sort of development. Without development, recreation can have serious negative impacts on the land.

**Damage in the Name of Fun**

Everyone who has ever hiked, camped, fished, skied, or participated in any form of recreation, knows what it's like to come across other people's garbage. There is also trampled vegetation and exposed and eroded soil. Most of us have also seen damage to facilities built for our use and comfort, graffiti, firepits filled with empty tin cans and broken bottles and well, you get the idea! Natural areas are not anything like being at home, where sometimes a family member or friend may pick up after you. Although Nature can often take care of itself, we are capable of a lot of damage in a relatively short period of time. It can take many years for the "scars to heal" naturally.

A steward is someone who is in charge of managing another's property. If we refuse to be a steward of the land then who is responsible? In the end, we all are, as citizens of the province. The Provincial Government will ultimately have to clean up the damage we have created. As taxpayers or future taxpayers, then, we foot the bill for the damage we've done. The concern is not only the money that will have to be spent cleaning up and reclaiming areas. It is the ugly scars that we create as a result of practicing ***irresponsible*** recreation.

## Responsible Recreation

It is not difficult to be responsible when spending time outdoors. The old method of cutting trees and spruce boughs for a lean-to can be replaced by using ropes and a plastic sheet, or by using a tent. Tents are now designed to be easy to use, strong, yet light to carry, unlike the once popular canvas tents. Stoves are made portable and small enough to fit in a pocket of a jacket or knapsack. There is no longer the need to rely on a campfire for cooking. Although cooking on a campfire is a fine skill and an enjoyable one too, it is now possible to limit your use of campfires for meals. If you do build a fire, use a fire pit that already exists, and keep your fire small. If you can't find a fire pit, make one by removing the vegetation, like a piece of turf and setting it off to the side. Next, remove about 15 to 20 cm of soil, store it off to the side and then build your fire. When you leave the site, be sure to reclaim the fire pit. After you soak the embers with water and you are sure the fire is out, scatter them about the area. Replace the soil in the pit and lastly, the vegetation. If there isn't an outhouse or similar facility in the area, designate an area for that purpose. Use the same method you used as for the firepit, except after each use, spread some of the soil in the pit. Again, before you leave the area, completely reclaim it with the remaining soil and piece of vegetation. There shouldn't be any indication you were there. This is what is known as "no-trace camping".

While on your way to camp, or wherever you are heading, remember to stay on the trail. Proper footwear will help you to resist the temptation of wandering off wet or muddy trails. If everyone were to wander, trails would be heading off in every direction, creating damage that is more difficult to manage because it is not concentrated to one area. Examples of this can be clearly seen, especially in the sensitive and fragile alpine areas, where ground cover is sparse and soils are so thin. The "stay on the trail" advice applies not only to hikers, but equestrian and OHV users as well. OHV's are any vehicles capable of off-highway use and include ATVs, quads, 4x4s, dirt bikes, trail bikes, mountain bikes and snowmobiles.

There are some areas designated for OHVs and equestrian use. If there is no restriction and you wish to explore the area, use common sense! Stop along the trail and look back at your tracks. Did it look like that as you approached it? If you sense that the area cannot withstand your mode of travel, then find an area that can. The Alberta Forest Service can usually recommend suitable areas to meet your needs. Many foresters agree that the major threat to natural areas is not major resource developments, but inappropriate outdoor recreation activities being practiced. Even though some areas are designated to restrict motorized vehicles and other activities like random camping, many people are defying the policy and doing these things anyway. The effect of these activities can already be seen. The general public needs to understand the reasons for designations of prime protection. Hopefully, this understanding will lead to responsible recreation.

### *Tread Lightly!*

A well recognized program in the United States, called *Tread Lightly!* is now gaining momentum in Canada. The idea behind the program is to educate the public about responsible use of OHVs. It began as a result of many natural areas in the country being closed due to environmental abuse and damage. Canada, including Alberta, is in the process of adapting the *Tread Lightly!* program to suit our needs. It is a proactive measure to eliminate the need to place OHV restrictions on public lands. However, the key to the success of the program, whether you are formally involved or not, is to be responsible when recreating outdoors. This applies to both public and private lands.

Practicing responsible recreation can be as simple as carrying out what you carry in, taking nothing but pictures and leaving nothing behind. It is up to each of us to care for the land. Although natural areas may appear to be never-ending, this will be the case only if we become stewards of the land, practicing responsible recreation!

**Questions:**

1. When we hear about protecting land from development, we often exclude recreation as a form of development. Most recreation requires some development, varying in intensity, depending upon the type of recreation.

    Compare the amount of development that would be required for each of the following: a) a downhill ski area, b) a golf course and c) a backcountry hiking trail leading to a primitive campsite. In your comparisons include a listing of the structures and facilities required in order for each to be operational.

2. What sorts or amounts of damage could occur if recreation were excluded from management? Explain your answer.

3. What forms of development are used as a management tool in heavily used day-hike areas? Give examples.

4. In terms of the Brundtland Commission's recommendation that approximately 12% of the total land area be set aside for protection, do you think recreation should be allowed in these protected areas? Qualify your answer with reasons, including any circumstances you wish to be considered.

5. How does recreation contribute to the economy of Alberta?

6. “If we overprotect and conserve, the option for development will still be there. But, if we overdevelop now, the option to protect and conserve is lost forever.” Explain these statements and tell why you agree or disagree.

7. Answer the following questions with explanations.
    a) Is it necessary to protect land in all Natural Regions simply because we have these different regions?
    b) If the Canadian Shields is protected in Ontario, is that enough, or must we protect a part of it in Alberta too?

## Reading #10 Managing Special Wastes

One of the more prominent environmental issues in recent years has been the management of special wastes. Our society now produces and uses a wide range of chemicals in volumes that have never been seen before, many of which form potentially hazardous wastes. These chemicals have become an important part of global economic development. In many parts of the world, these hazardous materials are manufactured and used without a clear idea of how they will be disposed of. As a result, many are disposed of inappropriately by being released into the environment, which contributes to the degradation of land, air and water.

In Alberta, special waste management goes far beyond this. Albertans generate about 100,000 tonnes of special wastes per year. Facilities are in place in this province to manage special wastes from their manufacture, to use, and finally to disposal. The Alberta Special Waste Management Corporation was established to monitor special wastes in Alberta and facilitate the delivery of these materials to the Alberta Special Waste Treatment Centre near Swan Hills for disposal. The proper management of these wastes is one step towards maintaining the natural environment of Alberta far into the future.

What is a "special" waste? Other words to describe these wastes include "hazardous" or "toxic wastes." Special wastes are materials that cannot be disposed of safely by normal waste management techniques, like storage in a sanitary landfill or disposal into a sewage system. A barrel full of toothpaste qualifies as a hazardous waste, because of the high concentration of fluoride in the toothpaste. Fluoride would cause some environmental degradation if it was released. Many wastes that qualify as hazardous wastes are chemicals that we commonly use around our house, including used oil, antifreeze, old paint, paint thinner, household cleaners, drain cleaners, etc. Industrially produced special wastes include materials containing metals like lead and mercury, acids, bases, and organic chemicals like PCBs (Poly Chlorinated Biphenyls).

How are special wastes often disposed of? Many of these chemicals are poured down the drain. While many urban areas have waste water treatment centres, none of these facilities are equipped to completely remove these chemicals from the waste water. Wastes that are poured down storm sewer drains travel directly to the river, lake or sewage lagoon without any treatment. As a result, chemicals can end up in natural aquatic ecosystems where they can cause degradation. Other hazardous wastes are simply dumped on the ground. This can cause long term degradation of the soil and perhaps contaminate surface or groundwater. Many companies realize that these wastes should not be released into the environment. However, if local facilities to properly dispose of the chemicals do not exist, the only other solution is to store these materials long term. Throughout North America there are landfills and warehouses in which barrels and containers of these wastes are being stored.

In Alberta there is no need to dump or store these wastes. Instead, they can be safely disposed of using three distinct processes; all used at Swan Hills:

1) ***High temperature incineration*** is used to destroy wastes which are organic or hydrocarbon based. Examples of organic wastes are solvents, paints, pesticides, contaminated oil and PCBs. These wastes can come in liquid, solid or semi-solid (sludge) form. The incinerators are carefully designed and operated to safely destroy over 99.9999% of the waste, leaving essentially only water vapour and carbon dioxide to be emitted out of the stack. The ash that is left over from burning is inert but is still given further treatment before landfilling.

2) ***Physical and chemical processes*** are used to treat inorganic wastes such as acids, alkalis, heavy metals and cyanide. Some of the processes used are neutralization, oxidation, reduction and precipitation, all of which make the waste less toxic.

3) ***Residue disposal*** is used to contain material left over from the other treatment processes. Ash from the incinerator, for example, is mixed with a kind of cement before it is put in a secure landfill. The landfill is built on dense clay and is lined with thick plastic to prevent any leakage into the ground.

   Liquid waste water residues are tested before being poured down a deep well. This waste water is not toxic and comes mainly from rainwater from the site and cooling water from the incinerators.

An important advantage of the Swan Hills Treatment Centre is that all wastes are completely handled on the site. Hazardous materials are destroyed soon after they arrive. The centre is designed so that the entire site forms a dish, to help contain contaminants. Even natural precipitation that falls on the site is collected in a sump, treated if necessary and recycled. Snow that is cleared from the parking lot in front of the centre is treated in the same way. Any contaminated overalls, gloves, or other equipment is kept on site, and destroyed as solid hazardous waste. Trucks that deliver the special wastes to the centre are cleaned before they are allowed to leave the site. The local plants, animals, air and water sources undergo regular studies to ensure that contaminants are not reaching the natural environment. The goal of the centre is to properly dispose of special wastes without creating other environmental problems.

How are wastes collected? Household special wastes are collected through a program called Toxic Roundup. Citizens of Alberta are encouraged to collect their special wastes and deliver them to the local fire hall or designated Toxic Roundup site. From there, these wastes are, if appropriate, recycled or packed into clearly labelled barrels and shipped to the Swan Hills facility.

For companies around Alberta, the Alberta Special Waste Management System has a fleet of trucks that will collect material and deliver it to either a temporary storage facility, such as the transfer station at Nisku, or directly to the treatment centre. First, the company contacts the treatment centre, describes their waste problem and sends a sample of the waste to the centre. There it is analyzed and a decision is made about the appropriate treatment for the waste. The company is then charged a basic disposal fee. This fee is known as a “postage stamp fee” because all companies in Alberta will be charged the same, whether they are located in Swan Hills or Medicine Hat. Once the waste is collected and delivered to the treatment centre, another sample is taken and analyzed. If any materials have been added to the waste, the load will be rejected and sent back to the producer. Otherwise, it is allowed to enter the site, where the truck will be unloaded and the waste disposed of as soon as possible.

There is no longer any reason for the inappropriate disposal of special wastes in Alberta, either by individuals or companies. Albertans are provided with a way of handling the disposal of these wastes in such a way that will not cause or lead to environmental degradation. Alberta is the only province in Canada to have a facility that can safely dispose of special wastes. Across Canada, hazardous wastes are stored or may be disposed of improperly.

The idea of shipping toxic wastes to Alberta from other provinces is not a new one. There are concerns over the transport of these special wastes, however. The possibilities of traffic accidents and train derailments are just two of many situations that could arise. Another concern is the amount of special wastes that should be allowed to enter Alberta. Presently, Alberta's facility does not have the capacity to treat all wastes generated each year in Alberta. Yet, Alberta's special wastes account for just a fraction of all that is generated in the whole country. The dilemma of how to handle special wastes continues for Canadians.

**Questions:**

1. a) Why do you suppose Swan Hills was chosen as the site for the Alberta Special Waste Treatment Centre?
   b) What advantages does this site have?

2. Alberta currently has a backlog of about 90,000 tonnes of special waste, and Albertans generate new special waste at the rate of about 300,000 tonnes per year, of which 25,000 to 50,000 tonnes require treatment at the centre. The current capacity (1992) of the treatment centre is about 20,000 tonnes per year.
   a) Where do you suppose the backlog is being stored?
   b) What do you suppose is happening to the 280,000 tonnes of hazardous waste that is being generated every year that is not being treated at Swan Hills?
   c) What could be done to reduce this volume of untreated waste? In other words, should we concentrate our efforts on disposing of these special wastes, or is there something else on which we should be concentrating? HINT: Think of the 3 Rs when answering.

3. The treatment plant has handled most of the liquid organic wastes in Alberta. When these wastes are used as fuel for the solid waste incinerators, the cost of running the incinerators decreases.

   a) Should the treatment plant begin to accept liquid organic wastes from other provinces to use as fuel?
   b) If so, under what conditions? If not, what would you suggest the other provinces do with their special wastes?

4. The Alberta Special Waste Management System is an extremely high-tech and costly system. The fees collected during the collection of the waste are not enough to make the facility pay for itself. Therefore, the system is supported by the Alberta Government.
   a) Is this expense justified?
   b) If you were the premier of Alberta, would you continue to support the system?
   c) Can you think of any methods that the system could use to become more self-supporting, without deterring people from using the facility?
   d) Could wastes that are received from out-of-province potentially be a source of extra revenue?

**Discussion Questions:**

1. If Alberta allows special wastes from Canadian provinces,
   a) should a limit be placed on the type of waste? the amount of waste?
   b) should waste be accepted from only a few provinces or all? Which provinces and why?

2. What effects could environmental degradation in other parts of Canada or the world have on Alberta?

3. Design a no-fail transportation system for the delivery of special wastes.

4. Should funding be provided for special wastes management centres in other provinces? Why or why not?

5. Who should be responsible for the cost of establishing special waste treatment centres and the ongoing treatment costs? Justify your answer.

6. The Treatment Centre is undergoing expansion which should be completed by October, 1993. The total capacity of the centre will then increase so that it can handle 58,000 tonnes of special waste per year. What are your views on this expansion?

7. The Treatment Centre is located approximately 20 km northeast of the town of Swan Hills, which is roughly the geographic centre of the province. The site was chosen not only for its suitability of soil types and other biological and physical factors, but just as important, local public acceptance. Although some citizens of Swan Hills were not convinced that the Treatment Centre would be a positive endeavour for their area, they are now satisfied with the result. Through open and honest discussion among the townspeople, Alberta Special Waste Management Corporation and the Government of Alberta, the Town welcomed the Centre. In fact, the Town submitted a proposal strongly recommending that their area be considered for the site. We hear of municipalities throughout Alberta that have difficulty in finding new landfill sites. In most cases this is due to public opposition moreso than environmental suitability. It therefore becomes more a social than a scientific issue.
   a) In this case, the Town of Swan Hills proposed that the Treatment Centre be constructed near their Town. What do you think made this case different?
   b) If you had to choose, would you prefer to live near a landfill or a special waste treatment facility? Why?
   c) What sorts of actions and by whom would help ease your mind regarding your acceptance of a waste facility, be it for special waste or a regular landfill?

## Evaluation: What are Your Comments?

We want to know what you think of this high school resource! Was it useful? How could we enhance it? What other topics should we address? We would appreciate it if you took a few minutes to evaluate this resource. Your input will enable us to better meet the needs of Alberta teachers.

**Name:** ______________________________

**School:** ______________________________

______________________________

1. What Reading(s) did you use with your students?

2. What grade(s) and subject(s) did you use the Readings to support?

   ***Reading (#)*** - ***Subject/Grade***

3. On a scale of 1 to 5, how would you rate the correlation between the LCEP Readings and the curriculum? (1 = low, 5 = high) Please comment.

4. How did the students respond to the Reading(s)? *(i.e.did they like/not like them?)*

5. Were the questions at the end of the Reading(s) useful? Do you have any suggestions for improvement?

6. What would you change or add to make this package more useful? Please be specific.

7. **Additional Comments.** If you have any further comments, please let us know! This will help us to make appropriate revisions and improvements.

*Please forward your comments to:*

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**Thank you for your time**

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